

## TYPHOON IAN (16W)

Typhoon Ian was the fourth of seven tropical cyclones to occur in the western North Pacific during September. Ian developed into a significant tropical cyclone six days after the second three-storm warning situation of the year involving Typhoons Freda (13W), Gerald (14W) and Super Typhoon Holly (15W) had ended on September 17th. Thirty-six hours after the first warning on Ian, it was joined by Tropical Depression 17W, which brought to seven the number of periods during 1987 that JTWC was warning on at least two systems at the same time. Even though, Tropical Depression 17W was a very short-lived system, Hurricane Peke (02C), which crossed the dateline (becoming Typhoon Peke (02C)), and Tropical Storm June (18W) soon took its place. This gave rise to the third three-storm warning situation of the year and the second to occur during September.

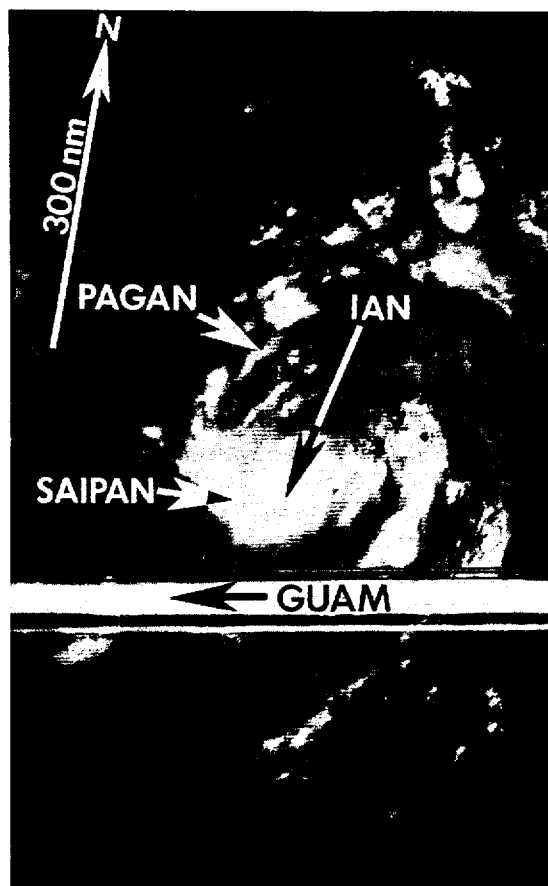
Forecasts verified extremely well on Typhoon Ian. The forecast track error statistics for all three verification times (i.e., 24-, 48- and 72-hours) were significantly less than the five-year average (see Chapter V, Tables 5-1A through 5-2B), though the 72-hour forecast error of 344 nm (637 km) exceeded the 1987

average. The reason for the poor 72-hour forecast errors was the unexpected slower movement of Ian between 270600Z and 290000Z when the system became nearly quasi-stationary while tracking generally toward the northwest. If this abnormal behavior had not occurred, JTWC's statistics on Ian would have been outstanding.

Ian began as a broad, poorly organized tropical disturbance 330 nm (611 km) to the east-northeast of Guam. Satellite analysts from Detachment 1, 1st Weather Wing (Det 1, 1WW) alerted the Typhoon Duty Officer to the presence of a persistent area of convection showing improved upper-level outflow. This was in the region where the monsoonal trough was attempting to become re-established after being disrupted by the previous three-storm situation. On 21 September at 0600Z, JTWC added the disturbance to its Significant Tropical Weather Advisory (ABPW PGTW) and listed its potential for development as poor due to the relatively high minimum sea-level pressures (MSLPs) evident in the trough at that time. Within 24-hours, the MSLPs decreased by 2 mb and the wind speeds increased another 5 kt (3 m/sec) to 25 kt (13 m/sec) (see Figure 3-16-1).



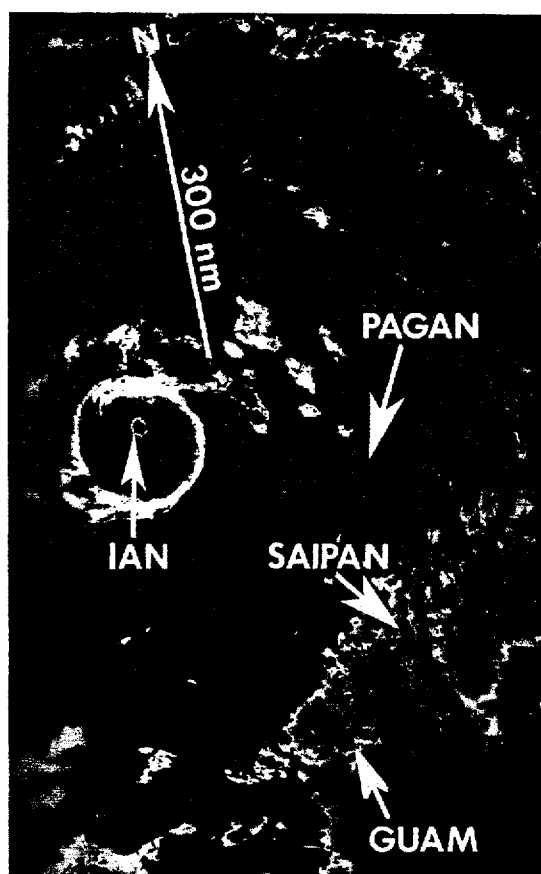
*Figure 3-16-1. Ian, as a tropical disturbance with 25 kt (13 m/sec) maximum sustained winds at the surface (220007Z September DMSP visual imagery).*



*Figure 3-16-2. Curvature is evident in the convective cloud lines just prior to JTWC issuing a Tropical Cyclone Formation Alert at 230130Z (222346Z September DMSP visual imagery).*

Ian continued its slow-paced development. Early on the 23rd, satellite imagery (see Figure 3-16-2) showed further intensification had taken place. Curvature became evident in the low-level cloud lines. Satellite intensity analysis (Dvorak, 1984) of imagery at 222346Z estimated 30 kt (15 m/sec) winds at the surface associated with this disturbance. JTWC promptly issued a Tropical Cyclone Formation Alert at 230130Z for the Mariana Islands north of Guam.

JTWC issued the first warning on Ian (as Tropical Depression 16W) at 230600Z, with an intensity of 25 kt (13 m/sec) and gusts to 35 kt



*Figure 3-16-3. Typhoon Ian approximately 12-hours before reaching its maximum intensity of 110 kt (57 m/sec). Note the small circular eye and compact central dense overcast (251146Z September DMSP enhanced infrared imagery).*

(18 m/sec), based on spiral bands of convection which became visible on visual and infrared satellite imagery. The system was upgraded to Tropical Storm Ian (16W) on the third warning (231800Z) as it progressed slowly westward into an area of low vertical wind shear.

At about that time, Ian began to develop at slightly greater than the normal Dvorak rate of one "T-number" per day. Wind speeds increased from 35 kt (18 m/sec) at 231800Z to 60 kt (31 m/sec) at 241800Z. Midway through this period, Ian turned from its westward course and began to move toward the northwest. Five radar fixes were obtained from Andersen Air

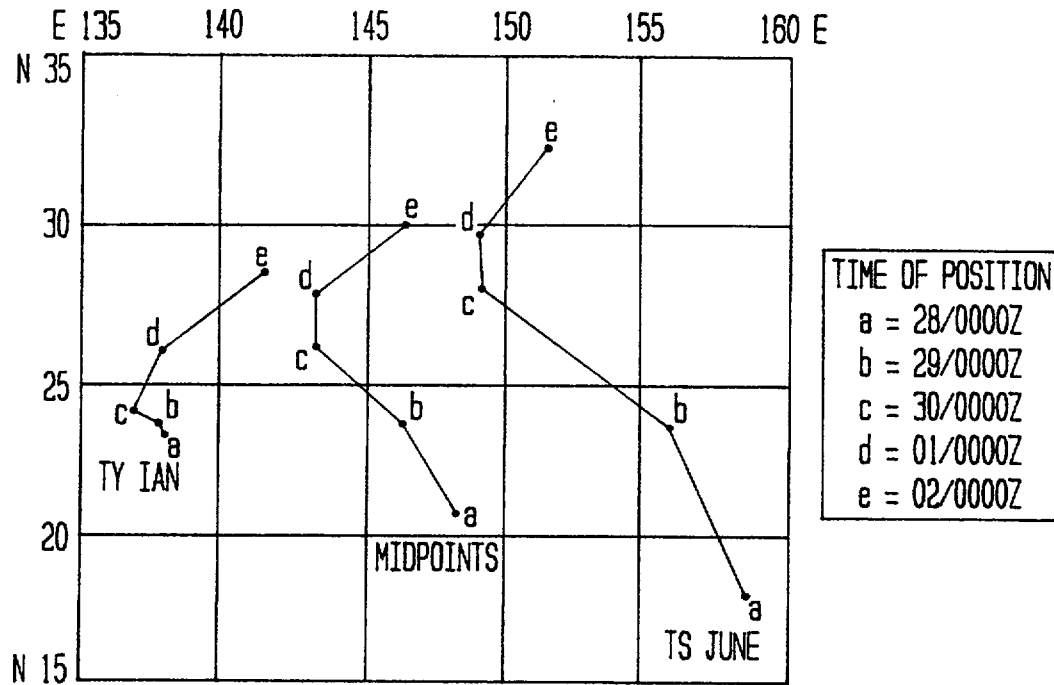


Figure 3-16-4. Plot of the slight binary interaction between Ian and June (18°W) showing their individual tracks and the path of the midpoints.

Force Base on Guam during this same time period. The center positions were based on the convective banding features. No eye feature was apparent on radar for any of the fixes.

Between 241800Z and 250000Z, Ian reached typhoon intensity as it moved steadily toward the northwest at 7 kt (13 km/hr). It intensified at a rate of 10 kt (5 m/sec) per six-hour interval (i.e., between warning times) from 241800Z through 260000Z (Figure 3-16-3). Note the small circular eye and the compact nature of the deepest convection. Ian reached its maximum intensity of 110 kt (57 m/sec) at 260000Z. It

was during this time of steady intensification that Tropical Depression 17W developed and then dissipated to the east of Ian. No binary interaction was apparent between them. A steady, slow decline followed. Twenty-four hours after Tropical Depression 17W had dissipated Ian slowed dramatically in forward speed as it approached a mid-latitude front lying just to the east of the Ryukyu Islands. Ian inched slowly northward between the times of 270600Z and 290000Z at a rate of less than 2 kt (4 km/hr). Its deep central convection decreased significantly. The movement of a mid-latitude shortwave north of Ian appeared to

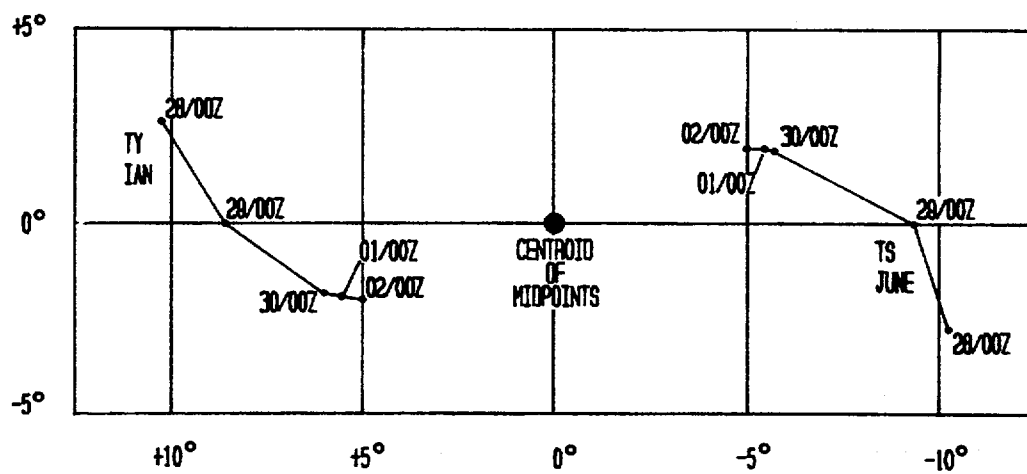


Figure 3-16-5. Plot of the center-relative movement about the midpoint centroid.

have suppressed it. Once this shortwave moved off toward the east on the 29th, Ian's upper-level outflow became aligned with the jet stream (which was above the lower level front) and the system began recurving south of Japan.

Meanwhile Tropical Storm June (18W), which began its development on the 28th, was moving rapidly northwestward at 18 to 20 kt (33 to 37 km/hr). Ian and June (18W) were close to one another at this stage (within 400 nm (741 km)) and eventually underwent a slight binary interaction between 300000Z September and 020000Z October. In Figure 3-16-4, the midway point is plotted for the times the two systems coexisted. Figure 3-16-5 shows a plot of the relative movement of each system with respect to the centroid position. As Ian and June (18W) moved northeastward and dissipated, the separation between their tracks decreased.

Ian continued to slowly weaken as this interaction took place, however JTWC forecasters and the Det 1, 1WW satellite analysts misread the changes to Ian on satellite imagery. Dvorak analysis at 010600Z October estimated Ian's intensity at 30 kt (15 m/sec), which supported a final warning and a downgrade to tropical depression intensity. Post-analysis indicates that Ian most probably transitioned to a subtropical system (rather than extratropical since the subtropical ridge was located to the north of Ian) and still had 55 kt (28 m/sec) winds at the time of the final warning.

The remnants of Ian continued to move northeastward after it transitioned to subtropical and finally dissipated 1200 nm (2222 km) to the east of Japan on the 4th of October. No damage or deaths were attributed to Ian.